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सुविचार इस शब्द में ही विचार आता है विचारों की इस बदलती श्रृंखला में ओर बदलते दौर में हमे सुविचार के माध्यम से कुछ कर दिखाने की प्रेरणा मिलती है हमारे लिए प्रेरणादायक होंगे.. सूविचार – Suvichar पढ़ने के बाद हमारे मन को एक नयी उर्जा मिलती है, जो हमें हमारे सभी काम सकारात्मक उर्जा के साथ करने के लिए प्रेरित करती है यदि आपको मेरी पोस्ट अछि लगती है तो फॉलो करें।

Sunday, 6 January 2019

Single Axis Solar Tracking System using 555 IC

DUAL- AXIS TRACKING SYSTEM USING ARDUINO

Single Axis Solar Tracking System using 555 IC

ABSTRACT

As the energy demand and the environmental problems increase, the natural energy sources have become very important as an alternative to the conventional energy sources. The renewable energy sector is fast gaining ground as a new growth area for numerous countries with the vast potential it presents environmentally and economically. Solar energy plays an important role as a primary source of energy, especially for rural area. This project aims at the development of process to track the sun and attain maximum efficiency using 555 IC AND LDR Sensor for realtime monitoring. The project is divided into two stages, which are hardware and software development. In hardware development, two light dependent resistor (LDR) has been used for capturing maximum light source. Servo motor has been used to move the solar panel at maximum light source location sensing by LDR. The performance of the system has been tested and compared with static solar panel. This project describes the design of a low cost, solar tracking system. In this project a single axis solar tracking system has been developed by which more energy from the sun can be harnessed. In this project, an, 555IC, has been used as the main controlling unit. To detect the position of the sun on the sky, two LDRs have been used and to rotate the orientation of the Solar PV panel a servo motor has been used. The sensors and servo motor have properly been interfaced. The servo motor has been mechanically coupled with the PV panel. The whole system has been assembled together and its performance has been tested. This tracker changes the direction of the solar panel based on the direction of the sun facing to the panel successfully. Single axis solar tracker tracks the sun on daily basis and makes the solar panel more efficient.

INTRODUCTION

The conversion of solar light into electrical energy represents one of the most promising and challenging energetic technologies, in continuous development, being clean, silent and reliable, with very low maintenance costs and minimal ecological impact. A photovoltaic panel is a device used to capture the suns

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radiation. These panels consist of an array of solar cells. The solar cells are made up of silicon (sand). They are then connected to complete a photovoltaic (solar) panel. When the sun rays are incident on the solar cells, due to the photovoltaic effect, light energy from the sun is used to convert it to electrical energy. We know that most of the energy gets absorbed, when the panels surface is perpendicular to the sun. Stationary mounted PV (photo voltaic) panels are only perpendicular to sun once a day but the challenge for is to get maximum energy from the source, so for it we use ckers on which the whole system is mounted. In tracking system, solar panels move according to the movement of sun throughout the day. There are three methods of tracking: active, passive, chronological and manual tracking systems. In active tracking system, the position of the sun is determined by the sensors. These sensors will trigger the motor to move the mounting system so that the panels will always face the sun rays perpendicular to it throughout the day. But in this system it is very difficult for sensors to determine the position of sun in cloudy days. So it is not a very accurate. In its Passive tracking systems, which determines the position of the sun by moving the panels in response to an imbalance pressure between the two points at both ends of the trackers. The imbalance pressure caused by solar heat creates a gas pressure on a low boiling point compressed gas fluid that is driven to one side or the other accordingly, which then moves the system. This method is also not accurate as the shade /reflectors that are used to reflect early morning sunlight to "wake up" the panel and tilt it towards the sun can take nearly an hour to do so. A chronological tracker is a timerbased tracking system whereby the structure is moved at a fixed rate throughout the day. The theory behind this is that the sun moves across the sky at a fixed rate. Thus the motor or actuator is programmed to continuously rotate at a "slow average rate of one revolution per day (15 degrees per hour). This method of sun-tracking is very accurate. However, the continuous rotation of the motor or actuator means more power consumption and tracking the sun. In manual tracking system, drives are replaced by operators who adjust the trackers. This has the

benefits of robustness, having staff available for maintenance and creating employment for the population in the vicinity of the site.

Tracker systems follow the sun throughout the day to maximize energy output. The Solar Tracker is a proven single-axis tracking technology that has been custom designed to integrate with solar modules and reduce system costs. The Solar Tracker generates up to 25% more energy than fixed mounting systems and provides a bankable energy production profile preferred by utilities

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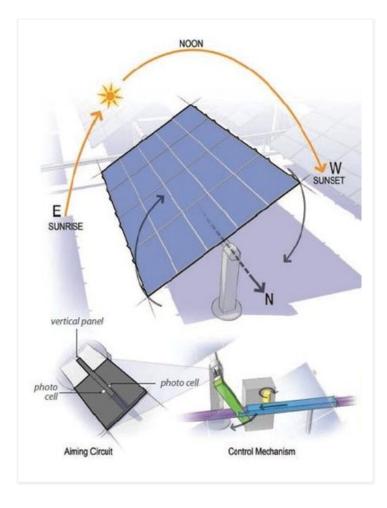
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SINGLE- AXIS TRACKING SYSTEM

The single-axis solar tracking system analyzed in this paper consist of a PV panel rotating around a tilted shaft under the action of a Bidirectional Motor that is controlled according to the real sun position, estimated by means of two light intensity sensors. The light sensors consist of two LDRs placed on either side of the panel separated by an opaque plate. Depending on the intensity of the sun rays one of the two LDR is shadowed and the other is illuminated. The LDR present on the side, in which the intensity of the sun rays is higher, will generate a stronger signal and the other will generate a weaker signal. The difference in the output voltage between the two LDRs will help in the movement of the PV panel in the direction in which the intensity of the sun rays is maximum. In this 555IC is used to command the DC motor by giving pulse signal to it. Relay controls the rotation of the motor either to rotate clockwise or anticlockwise.

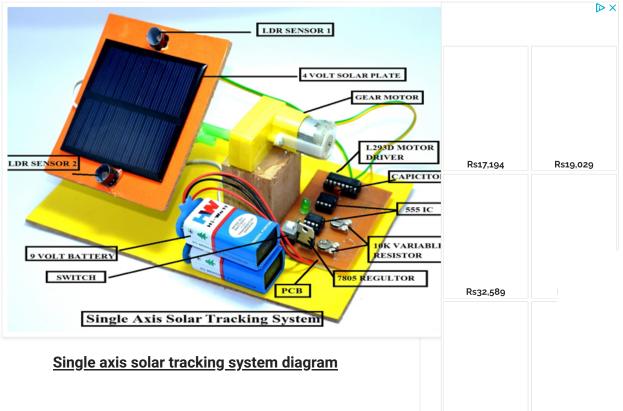
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COMPONENTS OF SOLAR TRACKER

Solar panel: Solar panels are devices that convert light into electricity. They are called "solar" panels because most of the time, the most powerful source of light available is the Sun, called Sol by astronomers. Some scientists call them photovoltaic which means, basically, "light-electricity."

A solar panel is a collection of solar cells spread over a large area and can work together to provide enough power to be useful. The more light that hits a cell, the more electricity it produces.



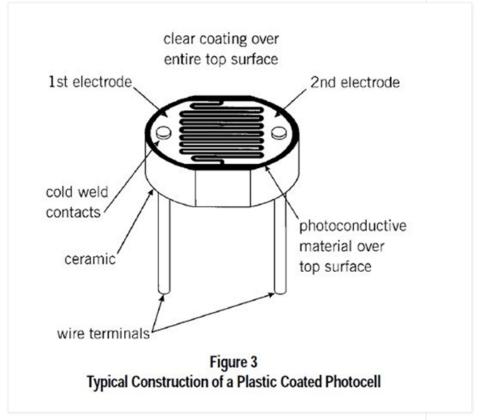
Fig :Solar Panel Diagram

<u>Light Dependent Resistors</u> A photoresistor (or light-dependent resistor, LDR, or photo-conductive cell) is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photo resistor can be applied in light-sensitive detector circuits, and light-activated and dark-activated switching circuits.

A photo resistor is made of a high resistance semiconductor. In the dark, a photo resistor can have a resistance as high as several mega ohms $(M\Omega)$, while in the light, a photo resistor can have a resistance as low as a few hundred ohms. If incident light on a photo resistor exceeds a

certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of a photo resistor can substantially differ among dissimilar devices. Moreover, unique photo resistors may react substantially differently to photons within certain wavelength bands.

The solar tracker system will obtain its data from two CDS (Cadmium Sulfide) photocells, which are type of LDR. The material used in CDS photocell is of high resistance semiconductor. Therefore, once light falls on its surface, photons absorbed by the semiconductor will give bound electrons enough energy to jump in to the conduction band. As the result free electrons conduct electricity and thus lower the resistance. In case of high intensity, photocell will produce lowest resistance, the opposite will occur in case of complete darkness.



light-emitting diode (LED):-

LED is a semiconductor light source that emits light when current flows through it. When a current flowsthrough the diode, electrons are able to recombine with electron holes within the device, releasing energyin the form of photons. This effect is called electroluminescence. The color of the light (corresponding tothe energy of the photons) is determined by the energy band gap of the semiconductor. White light isobtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductordevice. Parts of a conventional LED.

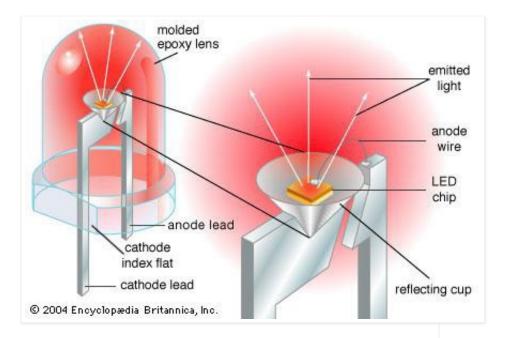


Fig :Led Diagram

<u>Capacitor:</u>-A capacitor can store electric energy when it is connected to its charging circuit. And when it is disconnected from its charging circuit, it can dissipate that stored energy, so it can be used like a temporary battery. Capacitors are commonly used in electronic devices to maintain power supply while batteries are being changed.



Fig:Capacitor Diagram

Resistor:- it is an electrical device may be a passive two-terminal electrical part that implements resistance as a circuit component. In electronic circuits, resistors unit of measurement accustomed reduce current flow, alter signal levels, to divide voltages, bias active components, and terminate transmission lines, among completely different uses.



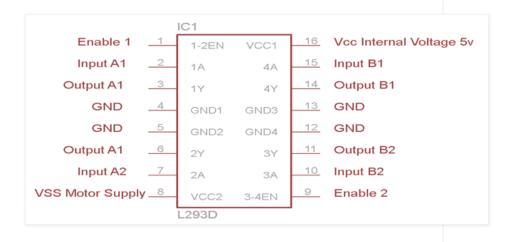
Fig:Resistor Diagram

L293D IC:- L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Dual H-bridge *Motor Driver integrated circuit (IC)*. The I293d can drive small and quiet big motors as well, check the Voltage Specification In a single L293D chip there

are two h-Bridge circuit inside the IC which can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors. Given below is the pin diagram of a L293D motor controller.

There are two Enable pins on I293d. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high. For driving the motor with left H-bridge you need to enable pin 1 to high. And for right H-Bridge you need to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch.

TIP: you can simply connect the pin16 VCC (5v) to pin 1 and pin 9 to make them high.



<u>555 IC:-</u> The **555 timer IC** is an integrated circuit chip used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip-flop element. Derivatives provide two (556) or four (558) timing circuits in one package

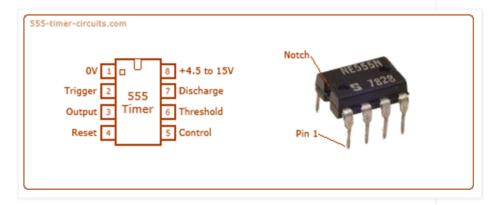


Fig:555 IC Pin Diagram

<u>DC Gear Motor:-</u> gear motor is an all-in-one combination of a motor and gearbox. The addition of a gear head to a motor reduces the speed while increasing the torque output. The most important parameters in regards to gear motors are speed (rpm), torque (lb-in) and efficiency (%). In order to select the most suitable gear motor for your application you must first compute the load, speed and torque requirements for your application.



Fig :Dc gear motor Diagram

Battery cap:- A battery assembled cap, a cylindrical battery with the cap and a method for making the same. ... The vent cap is attached to the battery cover by a hinge connection which allows for play between the vent cap and the battery cover and which allows for rotation of the vent cap.

Fig:Battery cap Diagram



Voltage Regulator:- A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. A voltage regulator generates a fixed output voltage of a preset magnitude that remains constant regardless of changes to its input voltage or load conditions. There are two types of voltage regulators linear and switching

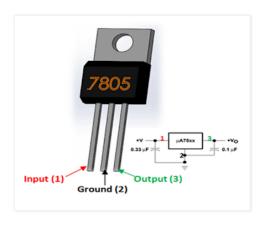


Fig: Voltage Regulator Diagram

Switch:- A switch, in the context of networking is a high-speed device that receives incoming data packets and redirects them to their destination on a local area network (LAN). A LAN switch operates at the data link layer (Layer 2) or the network layer of the OSI Model and, as such it can support all types of packet protocols.

Fig: Switch Diagram



7. Battery :-

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to thepositive terminal. When a battery is connected to an external electric load.

Fig :Battery



Construction:

Two CDS cells are connected to port RB2 and RB3 of the PIC. the two photocells are positioned on a small straight piece of wood or plastic. Another piece is mounted perpendicular to the straight piece, thereby dividing both the sensors. If both the photocells are equally illuminated by the sun, their resistance level will be same. As long as the resistance is same, an error margin of ± 10 points, the PIC will analyze this data and thus will not generate any signal to actuate the motor. if one of the sensor comes under a shadow, then the PIC will detect this change and thus it will actuate the motor to move the sensor module to a position where equal light is being illuminated on both of them. The PIC is programmed so that it can obtain its resistance data from the two LDRs and to move motor either clock wise or anti clock wise depending on which LDR is under shadow. The concept of the software design is dependent on the LDR that is under shadow.

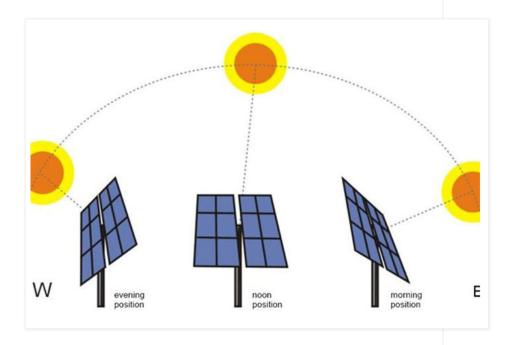
Solar tracker works by using a 555IC which compares light intensity illuminated onto the LDRs. The logic that works on the LDR to detect the signal is based on a resistance capacitor timing circuit, (RC constant), . Once the signal is fed into the input for RB2 and RB3, the program compares the two inputs and then the differences are detected and send an output signal from port RB0 and RB1 to let the motor move clockwise and counter clock wise respectively. The signal that is sent from output port RB0 and RB1 is logic level of 1 and 0, logic 1 is high level and 0 is for low level, when logic high is sent to the base of the transistor, it energizes and makes a closed circuit, thus a current flows through the motor, only two transistors can be switched on and off at a time The materials used in the construction of this prototype include Polyvinyl Chloride (PVC), one and a half inch pipes, wooden base of Medium-density fiberboard (MDF), stool which can rotate 360 degrees, automotive motor and bicycle gear mechanism. The description on how each section of the prototype is built is as follows: Five pieces of PVC pipe with equal length are connected back to back onto a Tjunction and each junction is connected to L-shaped PVC making a stable base onto which the motor can be mounted. The length of each PVC pipe is approximately 0.5 meter. A wooden base is placed on top of the square shaped design, the motor is then mounted below the wooden board, this way the motor is upside down thus

its gear is facing downward as well. The hydraulics portion of the revolving office chair is used which can rotate 360 degrees. A gear is then welded onto the hydraulics part using an electric welding machine. The chair is mounted onto the wooden base; this base has dimensions of one meter by 0.8 meter in length and width respectively. Once the hydraulic portion is mounted, the PVC base is placed in a position so that the small gear on the motor is in perfect alignment with the big gear which is mounted on the hydraulics. Once the two gears are aligned they are connected by a steel chain. The gear that is mounted on the motor has 14 teeth and that which is mounted on hydraulics portion has 30 teeth. These specific teeth are chosen because this combination produces more torque on less speed thus less current has to be applied to the motor, this concept is used for both the axes of movement. The horizontal axis is constructed by using two PVC pipes of size three inches in diameter, which are cut to length of 0.3 meters in height, the (MDF) wood is then later cut, 0.4 meter by 0.3 meter in length and width respectively. The PVC pipes are mounted into the shape of T-junctions. These junctions are then mounted on the MDF base, a hole is drilled on the PVC pipe at approximately 0.6 meters from the bottom, and another one inch PVC pipe is cut to a length of 0.5 meters, this pipe is inserted inside the three inch pipe, and the solar panel is mounted on it. Finally the motor and the gear are mounted on the side and linked using a chain for the horizontal axis and all the LDR"s are mounted and wired.

CONCLUSION

It has been proved through previous research that solar tracking system with single-axis freedom can increase energy output by approximately 20%, whereas the tracking system with double axis freedom can increase the output by more than 40%. Therefore this work in this paper is to develop and implement a solar tracking system with both degree of freedom and the detection of the sunlight using sensors. The control circuit for the solar tracker is based on a PIC16F84A microcontroller. This PIC is the brain of the entire tracking system, and it is programmed to detect the sunlight through sensors and then actuate the motor to position where maximum sunlight could be illuminated onto the surface of the solar panel. After many setbacks in testing of the solar tracker, a lot of time

is needed to be set aside for verification and testing due to the unpredictability of the weather and debugging of errors. This tracking implementation is successfully achieved with complete design of two degree of freedom using the PIC microcontroller. Suitable components and gear dc motors are used for the prototype model, which exhibit a clear, stable and precise movement to face the sun.



दुनिया का सबसे सस्ता जहाज



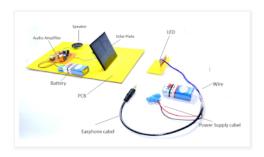
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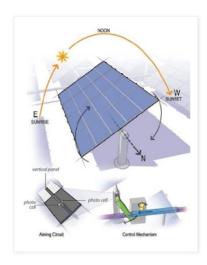
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